

Spatial Variability of Active Layer Thickness Detected by Using Ground-Penetrating Radar in Qilian Mountains over Western China

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ABSTRACT

During 2013 and 2014, we carried out a systematic investigation of active layer thickness (ALT) in the upper reaches of Heihe River, Qilian Mountains, western China, by using a multi-frequency ground-penetrating radar (GPR) with 100 MHz and 200 MHz antennas. We use in-situ data obtained by mechanical probing, site digging, and soil temperature gradients to validate GPR ALT results. The results showed that GPR was competent for detecting the ALT in the upper reaches of Heihe River Basin and the uncertainty was less than 6% at CMP co-located sites. The mean ALT was 133 cm with a range of 81~210 cm in Eboling Mountain. ALT varied from 107 cm at the north-facing slope to 484 cm at lower limit of permafrost with a mean depth of 271 cm in Yeniu Gou. ALT was mainly controlled by elevation in the upper reaches of Heihe River Basin and the gradient in Eboling Mountain and Yeniu Gou was -107 cm/100 m and -122 cm/100 m, separately. Aspect significantly influenced the ALT, and the results showed that ALT in the north-facing slope was about 94 cm thinner than the south-facing area. Furthermore, the mean ALT in different vegetation types varied a lot.